SCIENCE

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MSS. intended or publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson N. Y.

*A SAGE IN SCIENCE.**

BROOKS' lectures on the Foundations of Biology constitute a book that will live as a permanent addition to the common sense of science. It belongs to literature as well as to science. It belongs to philosophy as much as to either, for it is full of that fundamental wisdom about realities which alone is worthy of the name of philosophy. Writers of literature have been divided into those with quotable sentences, as Emerson and Thoreau, and those whose style runs along without break in the elucidation of matter in hand, as Hawthorne and Irving. To the former class Brooks certainly belongs. His lectures are full of nuggets of wisdom, products of deep thought as well as of careful observation. There is not an idea fundamental to biology that is not touched and made luminous by some of these sagacious paragraphs. Whether it be to show the significance of some unappreciated fact, or to illustrate the true meaning of some complex argument, or to brush away the fine-spun rubbish of theory, the hand of the master is seen in every line.

The main lesson of the work is that to believe is not better or nobler or higher

* The Foundations of Zoology, by William Keith Brooks, Ph.D., LL.D., professor of zoology in the Johns Hopkins University. A course of lectures delivered at Columbia University on the Principles of Science illustrated by Zoology. New York, The Macmillan Company, 339 pages; price, $2.50.

than to know. Belief adds nothing to certainty, and whatever is really true is the very best thing that could be true, else it had not been so. Dr. Brooks sees no reason for hoping, fearing or wishing in regard to truth. So long as it is true we can ask nothing better, and no new truth can be subversive of anything worth keeping in our previous stock of beliefs and inductions.

Dr. Brooks shows in many cases that problems over which scientific men have worried for years without result are at bottom mere questions of words. The facts at issue are recognized by all, but the matter of their final interpretation is one of the ultimate truths which science can never find out, for man can come in contact with no ultimate truth of any sort.

There is another class of problems which can never be settled by argument. We must wait until we know the truth. One of these concerns the existence of a principle of life which distinguishes vital processes from the operations of ordinary chemistry and physics. "Many biologists," says Brooks, "find their greatest triumph in the doctrine that the living body is a 'mere machine;' but a machine is a collocation of matter and energy working for an end, not a spinning toy; and when the living machine is compared to the products of human art the legitimate deduction is that it is not merely a spinning eddy in a stream of dead matter and mechanical energy, but a little garden in the physical wilderness; that the energy localized in *living* bodies, directed by similarly localized *vitality*, has produced a collocation of other material bodies which could not be brought about in a state of physical nature, and that the distinction thus drawn between the works of non-vital nature and those of life is both useful and justifiable. What this distinction may mean in ultimate analysis I know no more than Aristotle and Huxley; nor do I believe that any one will ever know until we find out. One thing we may be sure of, that it does not mean that the living world is anything but natural." Here he quotes from Aristotle, "That is natural *which holds good*, either universally or generally." If anything occurs, it is, therefore, natural.

"Faith and hope are good things, no doubt," says Dr. Brooks, "and 'expectation is permissible when belief is not;' but experience teaches that the expectation or faith of the master is very apt to become belief in the mind of the student, and 'science warns us that the assertion that outstrips evidence is not only a blunder but a crime.'" The key-note to the series of lectures is found in the introductory sentence that "life is response to the order of nature." "I should like to see hung," he says, "on the walls of every laboratory Herbert Spencer's definition to the effect that life is not protoplasm but adjustment; or the older teaching of the father of zoology, that the essence of a living thing is not what it is made of nor what it does, but why it does it."

The study of biology is the study of response and adaptation. The study of structure is the consideration of concessions to environment. The phases in development are related to the stimuli, external or internal, on which they are conditioned.

"It follows that biology is the study of response, and that the study of that order of nature to which response is made is as well within its province as the study of the organism which responds, for all the knowledge we can get of both these aspects of nature is needed as a preparation for the study of that relation between them which constitutes life."

The long dispute as to the inheritance of acquired characters is fairly closed by the words of Dr. Brooks. The arguments drawn from philosophical or analogical considerations are all brushed away, and

we are brought to the plain fact that no such inheritance is yet known to take place, and no one can yet say that it does not. "I find," he says, "as little value in the *a priori* arguments of those who hold that 'acquired characters' cannot be inherited as I find in Haeckel's assertion that 'belief in the inheritance of acquired characters is a necessary axiom of the monistic creed.'" In other words, *a priori* arguments are simple expansions of definitions or assertions, and can have no validity beyond that of the statements from which they are drawn. There is no truth to be derived from argument, *a priori*. If it is truth it is already known and needs no argument.

Dr. Brooks sums up his final conclusion that, whether "it be a real factor or not, the so-called Lamarckian factor (inheritance of acquired characters) has little value as a contribution to the solution of the problem of the origin of species, and renewed study has strengthened this conviction."

Dr. Brooks has a suggestive and valuable chapter in reproof of those who would place the law or principle of evolution as something apart or above the forces which are known to bring about orderly change or adaptation in living organisms.

"The tendency to regard natural selection as more or less unnecessary or superfluous, which is so characteristic of our day, seems to grow out of reverence for the all-sufficiency of the philosophy of evolution, and pious belief that the history of all living things flows out of this philosophy as a necessary truth or axiom.

"As no one can say that the basis for it [the philosophy of evolution] is not true, and as it seems much more consistent with scientific knowledge than any other systems of philosophy we must admit that, for all we know to the contrary, it may be true; and we may ask whether, if true, it is any substitute for science; although we must remember that there is no end to the the things which, while no one treats them seriously, may nevertheless be true. * * * While anything which is not absurd may be good poetry, science is founded on the rock of evidence.

"So far as the philosophy of evolution involves belief that nature is determinate or due to a necessary law of universal progress or evolution, it seems to me to be utterly unsupported by evidence and totally unscientific.

"Men of science repudiate the opinion that natural laws are rulers and governors over nature; looking with suspicion on all 'necessary' or 'universal' laws."

Again he says, "Natural laws are not rulers or governors over nature, but generalizations from an experience which seems to teach, among other things, that progress is neither necessary nor universal.

"The hardest of intellectual virtues is philosophic doubt, and the mental vice to which we are most prone is our tendency to believe that lack of evidence for an opinion is a reason for believing something else. This tendency has value in practical matters which call for action, but the man of science need neither starve nor choose."

Most suggestive chapters are those on the mechanism of nature with reference to Paley's famous argument for design in nature, and the varied changes which the argument for teleology has undergone. There is a constant plea against reading into the relations of nature more than is actually seen there, as also against the denial of that which may occur and yet has not been actually seen.

"We can give no reason why life and protoplasm should be associated except the fact that they are. And is it not equally clear that this is no reason why they may not exist separately?" In this connection we are given a charming analysis of the idealism of Agassiz, with the reason why

his wide-reaching suggestions have found so little favor among later naturalists.

"In order to prove that natural history is a language which we learn and listen to, to our entertainment and profit and instruction, he holds it essential to prove that it is *nothing but* a language; that the relations between living things and the world about them, being ideal relations, cannot possibly be physical ones also; that our 'laws of biology' are not 'necessary' but 'arbitrary.'"

The belief in Monism which Haeckel places first in his articles of scientific faith naturally wakens in Dr. Brooks little response. It is a philosophical expression wholly unrelated to reality. Whether it is the highest of all possible human generalizations or a mere play on words, science has no means of deciding, and man has no other court of appeal save his own experience.

I have already reached the limit of my space, while the majority of the passages I had marked for quotation are still untouched. The stones which Dr. Brooks has chosen as 'Foundations of Zoology' will remain there for centuries, most of them as long as human wisdom shall endure. The volume is a permanent contribution to human knowledge, the worthy crown of a life of wise thought as well as of hard work and patient investigation. If there are any errors in statement or conclusion, from one end of the book to the other, the present writer is not astute enough to find them out, and Dr. Brooks' logic may permit him at least to doubt their existence.

The biologists of America have long since recognized Dr. Brooks as a master, and this volume, the modern and scientific sequel to Agassiz's 'Essay on Classification,' places him in the line of succession from the great interpreter of nature, whose pupil and friend he was.

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FIELD-WORK OF THE JESUP NORTH PACIFIC EXPEDITION IN 1898.

THE Jesup North Pacific Expedition was organized in 1897 by Mr. Morris K. Jesup, President of the American Museum of Natural History, for the purpose of investigating the ethnology and archæology of the coasts of the North Pacific Ocean between the Amoor River, in Siberia, and Columbia River, in North America, the whole expense of the expedition being defrayed by Mr. Jesup.

During the year 1897 the field-work of the expedition was confined to the coast and interior of British Columbia. In 1898 the work was taken up on a more extended scale. Parties were in the field on the coast of the State of Washington, in the southern interior of British Columbia, on the coast of British Columbia, and on the Amoor in Siberia. On both continents ethnological work as well as archæological work has been done. While the parties in charge of the work on the American continent returned with the beginning of the winter, the work in Asia is being carried on.

The collections made by the various field parties of the expedition in 1897 are now on exhibit in the American Museum of Natural History. These collections represent the results of archæological work in the interior of British Columbia and on the coast. The ethnological collections are particularly full in regard to the tribes of Thompson River, of northern Vancouver Island, and of the central parts of the coast of British Columbia. The Museum has commenced the publication of the scientific results of the expedition in the form of memoirs. Up to this time two numbers have been issued—'Facial Paintings of the Indians of Northern British Columbia,' and 'Mythology of the Bella Coola Indians,' both by Franz Boas. Other results of the explorations in 1897 are in preparation, and will be issued in the course of the year.

Among these are the results of archæological work in the interior of British Columbia, by Harlan I. Smith; a description of the Thompson River Indians, by James Teit; and a discussion of conventional art among the Salish tribes, by Livingston Farrand.

The field-work of the expedition during 1898 was in the hands of Dr. Livingston Farrand and Mr. Roland B. Dixon, in the State of Washington and in southern British Columbia. The archæological work in British Columbia has been carried on by Mr. Harlan I. Smith. Investigations on the Indians of the southern interior of British Columbia were continued by Mr. James Teit. The ethnological work on the Amoor River, more particularly among the Gilyak, was carried on by Dr. Berthold Laufer, and archæological investigations in the same region were in the hands of Mr. Gerard Fowke. Following is a statement of the outline of the work of these parties, so far as available at the present time.

THE INDIANS OF WESTERN WASHINGTON.

In the plan of operations of the expedition along the northwest coast of the continent there was included from the beginning such research as might be needed to fill in certain gaps in our knowledge of the Indian tribes, from Vancouver as far south as the mouth of the Columbia River. The work of Gibbs, Boas, Eells, Willoughby and others had determined with considerable certainty the affiliations of the many tribes of this region, and in certain instances fairly complete information had been obtained regarding their customs, language, mythology, etc. There remained, however, a district on the west coast of Washington, from Cape Flattery to Grey's Harbor, of which little was known, and which promised valuable results upon investigation. It was consequently upon this region that the efforts of the expedition in Washington during the summer of 1898 were concentrated, the work being intrusted to Mr. R. B. Dixon, of Harvard University, and the writer.

The stretch of coast-line mentioned is about one hundred miles in length, and inhabited only at a few points, where the Indians have formed villages at the mouths of streams. South of Cape Flattery, which with its immediate vicinity is included in the Makah Reservation, the Indians of that coast are of two tribes—the Quilleute and the Quinault. The Quilleutes are the more northerly, occupying two villages; the larger, known as Lapush, at the mouth of the Quilleute River, about thirty miles south of Cape Flattery, contains all the members of the tribe except a few families who live at Hoh, a cluster of houses some fifteen miles farther south. South of Hoh the coast is uninhabited for about fifteen miles, as far as Queets, the more northerly of the Quinault villages, which contains but a few individuals; while twelve miles farther down the coast, at the mouth of the Quinault River, is the main seat of the tribe, known by the whites as Granville, which is a sub-agency of the Indian Department, with a resident agent and post-trader. The climate of this region is mild throughout the year, but with an extremely high rainfall from October to June. Being freed from the hardships of the severe winters of the interior, these coast Indians find it a comparatively easy matter to procure the necessaries of life at all seasons. The waters teem with salmon and other fish; shell-fish are abundant and much used; seal are hunted in the late spring, particularly by the Quilleutes, whose situation is more favorable for that purpose; and in the woods, which extend down to the beach at all points, deer, elk, black bear, and many varieties of small game, are abundant. The staple foods, however, of both tribes mentioned, are salmon (which are caught in great numbers with large nets,

dip-nets, and spears) and berries, gathered at the proper seasons and dried. Of late years, with the development of the salmon-canning and hop-growing industries in the regions about Puget Sound and the Fraser River, the life of these Indians has undergone a decided modification, due to the annual exodus of all able-bodied members of the tribes to secure work in the canneries and hop-fields. Employment is given to women, and even to children, and in prosperous seasons very considerable sums are earned by families, which money is, however, as a rule, promptly and not wisely spent at the nearest shop or trader's; and the Indians return to their homes in the autumn with little to show for their three or four months' labor except the experience, largely social, which is, after all, probably the great inducement which draws them to the work.

This absence of the Indians from their villages was the greatest obstacle to the work of the expedition in these two tribes.

Upon arriving at Lapush, about July 1st, it was found that the Quilleutes had gone in a body to the Fraser River for the fisheries, leaving behind a few men too ill to be carried, and enough women to look after their needs. Some days were spent in obtaining such linguistic information as was possible with the scanty material to work upon, and then, reports from the Quinaults being more favorable, the expedition proceeded to Granville, where some thirty individuals were found, the remainder having also gone to the Fraser River. The prospects being better at this point, it was decided to settle down and begin work. Measurements, casts, and photographs were obtained, as well as a mass of information regarding the language, customs, traditions, etc., of the people. As it was desirable to collect as large a series as possible of measurements and casts, it was decided early in August that Mr. Dixon should proceed to the Fraser River, and prosecute that work as well as might be under the rather unfavorable conditions presented. This he did with entire success, obtaining a very valuable series of casts and measurements, as well as notes on the languages of both the Quilleutes and Quinaults, and later visited the Lillooet Indians in British Columbia before returning East.

The writer remained at Granville for some weeks longer, making researches and collecting ethnological material for the American Museum of Natural History, and about September 1st returned to Lapush to meet certain of the Quilleutes who had returned, and obtain further information regarding that tribe. The members of the expedition returned to New York about Oct. 1st.

Of the results of the summer's work, aside from the collections made for the Museum, may be mentioned as of particular importance the casts, photographs, and measurements for a systematic study of the physical anthropology of the tribes; the linguistic material, which proves beyond question the stock affiliations of both groups, the Quilleutes being shown to be of Chemakum origin (the true Chemakum tribe, which formerly had its seat near Port Townsend, being now extinct), while the Quinaults are of the extensive Salish stock which occupies nearly all of the territory about Puget Sound, and sends this offshoot north along the coast. The traditions of the tribes, of which full collections were made, are extremely interesting, exhibiting the characteristics of the traditions of the northwest coast in general, and showing particular affiliations with the immediately adjoining tribes. A great many of the stories are identical in every detail in the two tribes, except for slight changes of name, although the tribes are of totally distinct stocks, and the language of each is unintelligible to the other. The well-known myth of the 'transformer' is found well developed

in both instances, and the tales of the Raven as culture hero and trickster, so well known among the Indians farther north, are heard here among the Quilleutes, while the same adventures are told of Blue Jay among the Quinaults, as is the case among the Chinook and other neighboring peoples in the south. These traditions will form an excellent basis for a comparative study of the mythology of the region.

Particularly valuable information in regard to the conventional development of design in basket ornamentation was obtained among the Quinaults, bearing out the theory that the common geometrical figures which are used so much are almost invariably conventionalized representations of natural objects, and, as a rule, of animals. Notes on the social life and beliefs of the Indians were also secured, and observations made on the influence of the so-called 'Shaker' religion, which has been gaining a strong hold on the natives of that section during the last half-dozen years. In general it is hoped that the work of the summer will contribute very materially to the solution of many of the problems, general and special, which are offered by the Indians of the Northwest.

Livingston Farrand.

ARCHÆOLOGICAL INVESTIGATIONS ON THE NORTH PACIFIC COAST OF AMERICA.

The archæological work conducted on the northwest coast of America, prior to the organization of the Jesup North Pacific Expedition, was not extensive. The available knowledge concerning it is largely confined to three publications—two by Dr. William H. Dall, on cave and shell-heap remains of the Aleutian Islands; and one by Mr. Charles Hill-Tout, a *résumé* of the archæology of the southwestern portion of British Columbia.

The archæological investigations which I carried on in connection with the Jesup Expedition during the past two years dealt chiefly with two problems: (1) examining the archæology of the southern interior of British Columbia; and (2) investigating the shell-heaps of the coast of Vancouver Island, together with those of the adjacent mainland.

In the southern interior of British Columbia, more particularly in the valleys of the Thompson and Fraser Rivers, now live tribes of the Salish Indians. This region is one of almost desert dryness. The houses of the Indians are covered with a roof of timbers and earth, and are partly underground. Unlike the tribes of the coast, who have such an abundance of the few staples —cedar, seal, salmon, and shell-fish—that they depend almost exclusively upon them, these people have to resort to a great variety of natural resources. Primarily among them may be mentioned the deer, which furnish them with skins for clothing, flesh for food, and bone and antler for implements. The sagebrush-bark is used for textile fabrics. Salmon are taken for food in the rivers, and berries and roots are obtained in the mountain valleys. Many objects are made of stone. They bury their dead in little cemeteries along the river, although an isolated grave is sometimes seen. Their method of burial in the ground, instead of in boxes deposited in trees, in caves, or on the ground, the conical form of their lodges, and their extensive use of chipped points of stone rather than of those ground out of stone, bone, and antler, ally their culture with that of the tribes of the East, and differentiate it from that of the coast people. None of the native peoples of British Columbia make pottery, and no pottery has been found by archæological work. Food was boiled by dropping hot stones into baskets or boxes containing it.

The archæological remains are found in the light sand of the valleys and hillsides. The wind is continually shifting this dry

sand from place to place. For this reason no definite age can be assigned to the specimens secured. It is certain, judging from the complete absence of European objects at many of the localities explored, that the remains found at these places antedate contact with the whites. A number of them must carry us back several hundred years. The modern Indians make small arrow-points, and disclaim the large kind found in excavations. The work undoubtedly proves that these ancient people and those now inhabiting this region were practically the same.

Numerous circular depressions were found, indicating the sites of ancient underground houses. The dry climate, and the action of copper salts, preserved bits of skin garments. Portions of the clothing, and bags that were made of the bark of the sagebrush, remain in the dryest places. Beaver-teeth dice, exactly like those used by the present Indians; digging-stick handles made of antler, similar to those in use to-day; charred berries; fish-bones; and skin scrapers made of stone—were unearthed.

The graves were found in groups and also singly, as is the case with the modern ones. The bodies were buried upon the side, with the knees drawn up to the chest. They were wrapped in a fabric made of sagebrush-bark, and were covered with mats of woven rushes. Over the forehead and around the neck were strings of beads, some of copper, others of dentalium-shell. At the side, in a pouch also made of woven sagebrush-bark, were usually found such objects as pieces of glassy basalt, points chipped out of the same material for arrows and knives, a pair of grooved stones which were used for smoothing and straightening arrow-shafts, a set of beaver-teeth dice, bone awls and needles, quantities of red ochre, copper-stained clay and yellow earth used for paint.

The beads of dentalium-shell from the Pacific coast probably indicate intertribal trade. A number of war-clubs and several small animal figures carved in bone were found. The handles of the clubs were artistically sculptured to represent human heads with plumed head-dresses. Such specimens show that the ancient people were capable of a high order of artistic carving, which, perhaps, more than any of their other work, resembles the products of the coast culture. Stones burned and crackled, evidently by basket or box boiling, are found at all the village-sites and shell-heaps explored in British Columbia.

Several specimens, such as the stone mortar and the tubular pipe, remind us of the types found in Oregon and California. Ethnological investigations have shown the affiliation of the recent culture of this region to that of the Rocky Mountain region. These archæological evidences suggest that this similarity was even greater in the past.

Turning to the problem of the shell-heaps of the coast, it is necessary to note that the present tribes of the coast of British Columbia build immense houses of cedar planks. They depend largely upon the cedar and other wood for their implements and utensils. The bark of the cedar is made into garments, bags, mats, and the like; in fact, the cedar is to these people what the bamboo is to the Japanese. They rely greatly upon salmon and shell-fish for food. The seal also furnishes them with food and material for manufactures. They have developed an exceedingly high art in carving and painting, which is quite characteristic for the North Pacific coast.

The most extensive remains of the early inhabitants of the coast are shell-heaps. Their general distribution may be judged by the fact that in the region, less than a hundred miles square, on the shore of the north end of Vancouver Island, and the

mainland opposite, over a hundred and fifty were noted. In general they are located at the mouths of fresh-water streams, and are several hundred yards in length by five or six feet in depth, while a few are miles in length, and some reach a maximum depth of over nine feet. The presence of stumps over five feet in diameter standing on nine feet of these layers, of which but few are more than an inch or two in thickness, indicates a considerable antiquity for the lower layers. These are composed almost exclusively of the well preserved shells of clams and mussels, scattered among which are found a very few points and barbs rubbed out of bone, such as were used recently for harpoons, and bone-choppers for preparing cedar-bark, exactly like the implements used to-day in the manufacture of cedar-bark, mats, and clothing. Numerous stone pebbles with battered ends, such as are still used in a game resembling quoits, and a copper ornament in shape like those made of iron and now worn in southern Alaska, were also found in the heaps. One pair of these ornaments, made of copper, was found in a grave in the interior. The extreme scarcity of archæological specimens in the very extensive shell-heaps of northern Vancouver Island is what we might expect if the early people depended as largely as do the present natives upon cedar products easily disintegrated by the warm, moist climate. The scarcity of human remains in the shell-heaps may be accounted for on the supposition that tree-burial, where the bodies fall and are soon destroyed or the bones scattered, was as extensively employed in former times as at present. Everything which has been found tends to prove that the ancient people who discarded the shells forming these immense heaps, over successive layers of which forest trees have grown to a diameter of four or five feet, were in all essential particulars similar in their culture to the tribes at present inhabiting the same areas.

The shell-heaps in the delta of the Fraser River, while in general resembling those of the coast, present several marked differences. There is much more black soil, charcoal, and ashes among the layers of the shell-heaps here than in those along the beaches of the sea. The shells are much more decayed, and mixed with the black soil. Among the layers are found numerous skeletons of two distinct types of men; and the proportions of specimens to the extent of the shell-heaps is vastly greater than in the other localities, the specimens in the coast shell-heaps being much separated by vast amounts of shell material. Whether these differences are peculiar to the lower Fraser River, or are common to all fresh-water streams of the region, is problematical; and their cause, whether due to a change in the customs of the people, or to a variation in the people by mixture or succession, is worthy of study.

The age of these heaps is considerable. A stump of the Douglas fir over six feet in diameter stood on one of the heaps where the layers, there reaching a depth of over eight feet, contained human remains. This tree indicates an age, for the top layers, of more than five hundred years; and allowing for the formation of eight feet of strata of shell, ash, and earth, most of which are but a few inches in thickness, it must be conceded that the bottom layers are much older than this rather conservative estimate for the minimum age of the top layers. The annual rings upon an ordinary stump standing upon this shell-heap numbered over four hundred. The circumference of another stump exceeded twenty-eight feet.

The shell-heap at Port Hammond, in the upper part of the Fraser delta, is over twenty miles by water from the present seashore, where the shell-fish are found. By land, the nearest point of seashore is over ten miles.

Judging from the customs of the present natives, the water route would be used. But they prefer to live near the shell-beds. It is hard to believe that any of them would carry shell-fish from the present seashore to the shell-heaps at Port Hammond. The distance that the delta is built out into the sea, and the time required for this deposition, may furnish us some information as to the age of the Port Hammond shell-heaps.

There is no apparent difference in the character of the specimens found in the recent and in the older layers. The general style of the objects is similar to those made by the present tribes of the coast. Several exquisite specimens of stone and bone carvings were discovered, which rival in artistic merit the best sculpture of the existing natives.

Two types of skeletons were found which belonged apparently to coexistent people, as they were excavated from the same layers. If one of these types consisted of captives or slaves, there was nothing in the manner of burial to indicate it. Probably one type succeeded the other in occupation of the area. The fact that bodies were found in shell-heaps indicates that the customs of this people must have differed from those of the people who formed the shell-heaps on northern Vancouver Island, or that the former people was subjected to other influence.

The skeletons found were deposited at the time of the layers, and were not intrusive burials, as was clearly shown by the numerous unbroken strata extending over them. The bodies were usually lying upon the side, with the knees close to the chest. Unlike the skeletons in the interior, these have but few, if any, objects accompanying them, except, in rare instances, a few shell beads, copper objects, and chipped and ground stone points for arrows, spears, etc. Such specimens, and even more interesting objects, were frequently found in the layers.

There has been an apparent movement in prehistoric times of the Salish of the upper Fraser toward the coast. The skulls found in the old shell-heaps of the delta differ from those of the present coast Salish. The modern coast Salish has a skull apparently modified from this by admixture since coming to the coast. This is only additional evidence to what has already been suggested by linguistic research. A movement of such importance, and its attendant influences, may account for certain changes in ethnological customs, such as the rapid modification of the method of burial on the southeastern part of Vancouver Island. The earliest known kind of burial, and the one that is known to have antedated contact with the whites by a considerable period, was in stone cairns. Later, and even since contact with the whites, the bodies were placed in wooden chests, which were deposited on platforms in the branches of trees. This method was changed to depositing the boxes in caves or on little islands. In such cases a canoe was sometimes used instead of a box. Now, under missionary influence and legal restraint, these people bury as do the whites of the region.

The cairns come within the field of archæological investigation. They consist of irregular piles of bowlders, from twelve to twenty feet in diameter, thrown over the body, which was placed in the usual flexed position. In most cases it was surrounded by a rectangular vault formed by placing the straight sides of four or five bowlders toward the body, and covering the cyst thus made with one or two slab-shaped rocks. Over this the rough pile of the cairn would be reared. A few copper ornaments have been found buried in cairns. The skeletons are usually much decayed, and complete skulls from the cairns are rarely obtained. In excavating twenty-one cairns in 1897 no entire bones were secured. In

1898, however, we met with better success, obtaining a number of complete skeletons.

Several burial-mounds were formerly located along the lower Fraser River, between Hatzic and Port Hammond. The remains in them are usually much decayed, and but little is known about them. The one which we found intact was explored by us, and its contents were seen to be much decayed.

It remains to find material upon which to reconstruct a knowledge of the builders of the burial-mounds of the lower Fraser River. The map showing the distribution of cairns should be completed. The marked difference between the shell-heaps explored along the salt water, and those investigated in the delta of the Fraser River, demands that inquiry be continued to determine whether this difference is correlated to salt- and fresh-water shell-heaps, to heaps of certain geographical areas, or is due to change in customs. The determination of the distribution of shell-heaps of both varieties is also necessary. Many of the specimens discovered in this work are known to be of considerable antiquity, and, on the whole, the culture shown by the archæological finds is similar to that of the present Indians. It is consequently known that this culture has continued practically unchanged during recent times. This being settled, it is desirable to learn of its development, for which it is imperative to search out older deposits. These may possibly be found in shell-heaps, under cave-floors, or in post-glacial gravels.

Harlan I. Smith.

American Museum of Natural History, New York.

ARCHÆOLOGICAL INVESTIGATIONS ON THE AMOOR RIVER.

The Amoor River, below Khabarovsk, flows through a succession of former lakes and the rocky barriers which separated them. There are extensive level tracts, the bottoms of drained lakes alternating with passes between hills or mountains. Nearly all the flats are subject to overflow. They are covered with coarse grass from four to seven feet high, and intersected in all directions by sloughs and bayous. At no point is the river less than a mile wide; in floods there are many places where no land is visible for ten miles or more; and at one locality it is fully twenty miles across. At such times the current in some parts of the channel flows from twelve to fifteen miles an hour. The shores are free from silt or mud. One may walk for miles on the beach, immediately after a heavy rain, without soiling his shoes. An important result of this, to primitive people, is that shell-fish are almost entirely lacking. A few periwinkles and occasionally a mussel are found, but there is not the slightest evidence that such were ever used as food. The water seems comparatively free from lime.

There is no flint from which arrow- or spear-heads could be made, and very little stone, except bowlders and pebbles on the shores, suitable for the manufacture of axes. None of the former, and very few of the latter, were found. Wood, bone and antler seem to have been about the only material for weapons and implements.

The winters are long and severe. A temperature of 67° below zero (Fahr.) has been recorded at Nikolaievsk, and a skim of ice was formed there in August (1898).

There are no roads. Navigation is possible for only four months, sledge travel on the river, another four, while for two months in spring and two in autumn all travel is suspended.

The hills are steep, rugged, and covered with fallen timber, brush and vines. Only hunters and prospectors ever go among them. In most places primitive wilderness is reached within a few hundred yards of

the stream. Short journeys may be made on the beach, but one soon comes to the outlet of a lake or swamp which cannot be crossed.

Settlements are confined entirely to the banks of the river, at points where there is good landing for canoes. Most native villages, and some belonging to the Russians, are subject to overflow. There are very few high terraces bordered by a good beach. On a rocky shore, canoes would soon be dashed to pieces by waves, which in severe storms attain a height of five or six feet.

Above the mouth of the Garoon River dwells the native tribe of Gold or Goldi. Below Sophisk, extending along the coast to Okhotsk Sea and Saghalien Island, are the Gilyaks. The intermediate territory is occupied by both tribes. At present they obtain guns and knives from the Russians; formerly they had only such hunting or fishing material as they could make for themselves or get from the Manchu traders.

In summer the elks come down from the mountains to feed on the lilies and grasses in the marshes. The Gilyak hunter secretes himself and patiently waits for his quarry to come within easy range. In winter they go, either singly or in a party, into the mountains to hunt fur-bearing animals. The sable is the chief animal sought, as a good skin is easily exchanged for its weight in silver, and a fine one brings much more. Sometimes they spend the entire winter at the camp, though it may be only a few miles from home.

At their summer camps they make huts of birch-bark. Sometimes there is constructed a framework of posts, cross-poles, and rafters, on which the bark is fastened by tough, twisted vines, the roof being held down by poles and stones. Again, they tie a bundle of poles together at the top, and spread the bottoms as far as they wish. This framework is covered with bark (or sometimes with skins, and nowadays possibly with tent-cloth), in the fashion of an Indian wigwam. A fire is made in the middle of the floor; blocks of wood, or short forks driven into the ground, support poles, brush, and grass for seats and beds.

Winter dwellings are more elaborate. A space is marked out from twenty to fifty feet square, the size depending upon the number of persons to be housed. The earth is excavated within these lines, the depth of the excavation being governed somewhat by the character of the soil. It is usually between two and three feet. Posts are set around the edge of this, on which a wattle is constructed; mud is thickly plastered on both sides. The roof is made of poles and heavily covered with mud. Earth is also piled up around the base of the house to a height of three or four feet. A fireplace or furnace is made of stones in one corner. A large kettle is set into the top of this, and every crevice chinked with mud. From the fireplace, flues extend around the sides of the room, made of flat stones set on edge and covered with others. There may be two, three, or four of these flues, side by side. If flat stones cannot be had, others are used, the interstices being chinked. In large houses two furnaces are made in opposite corners. All the flues unite finally into one, which is carried through the wall and to a chimney from fifteen to twenty-five feet away, on the outside. This may be a hollow trunk or may be made of boards. It furnishes sufficient draught in any weather. Over all the flues are piled sand and fine gravel, confined at the front by boards, and carefully levelled on the top. The 'bench' thus formed is sometimes six feet wide. The inmates literally live on it when in the house. It is always warm and dry when the fires are going.

A careful and methodical investigation was made along the river for three hundred and fifty miles above its mouth, and of the

coast along the Channel of Tartary as far as Okhotsk Sea. No evidence whatever could be found to indicate a former population different from the present. The swift current and high waves keep the gravel and sand of the beach continually shifting. It was possibly for this reason that so little was found on the shores. Not a worked flint was seen. There were hundreds of fragments of pottery, about thirty polished stone hatchets or scrapers, some notched sinkers and a few other stones, showing marks of use or attempts at shaping. Above the water-line, grass and weeds grow so abundantly that the ground is hidden. In the few places, where vertical exposures of the banks occurred, every foot was carefully examined; but there was not a fragment of pottery, a piece of charcoal, or any other evidence of human occupation, to be seen below the sod. This is true of all terraces, whether subject to overflow or not. The natives say the 'old people' (meaning thereby their predecessors, without regard to time) used the polished stone implements. Now better utensils can be had from the Russians. Most of the pottery is Manchurian, as is proved by its marking or decoration. The remains of a Chinese town may be seen in the woods at Tyr; three inscribed monuments formerly stood near here. The inscriptions have been deciphered, and prove to be Manchurian.

There are no shell-heaps, of course, because no shells; no mounds; no stone graves; no graves, except modern ones, with any mark to show their existence.

When a Gilyak house is abandoned, it soon goes to decay. The earth piled around the base is increased in amount by that falling upon it from the walls, and when the wood all decays there is left an embankment surrounding a depression. If the roof-timbers hold for a year or two, the earth is washed off and adds to the embankment; if this dirt falls directly downward, it lessens the depth of the depression.

In the entire region examined, these abandoned house-pits was found. In some, part of the timbers were still in their proper position. In others the timbers were all more or less decayed. In still others no trace of wood remained. Step by step could be traced the gradation from the house just deserted to the house-pit covered with moss and turf to an equal thickness with that on every side, and overgrown with pine trees up to thirty inches in diameter—as large as any observed along the river. All are constructed in the same way, and several which were trenched across showed the stone flues just as they are made at present.

There may be ancient remains here yet to be discovered; but so far none have been found which may not be properly attributed to the present native tribes, or to the Manchurians, who until recently owned this territory.

GERARD FOWKE.

ON BIOLOGICAL TEXT-BOOKS AND TEACHERS

A GENERAL indictment against text-books may be drawn, to the effect that, like the teachers who are usually their authors, they proceed on the assumption that all who pass through their sphere of influence are to become specialists in that particular department of knowledge. This tendency carries its own *reductio ad absurdum* and is the cause of frequent revolutions in 'methods of teaching.' A new phase of the subject, a new standpoint from which to present it, is at first tentatively added or partially substituted for the old course of study, with noticeably excellent results. Not realizing that the improvement is secured by the introduction of moderation, balance and sanity into the work of instruction, the inference is at once drawn that still more startling effects are possible through further progress in the direction whence the light

came. Very soon, however, the mean is passed, the new has become the old, the simple the complex, and another advance, return, or deflection, is in order.

The history of biological instruction in schools furnishes a good illustration of these phenomena. The systematists had the first botanical opportunity, which they proceeded to abuse. Not content with the original practice of giving beginners a slight acquaintance with the names and properties of the more prominent local plants, they arranged for the laying of broader foundations for systematic work; manuals containing thousands of species and requiring extended experience for their profitable use were put into the hands of academic pupils prepared only by a brief course in definitions. The vital activities of plants went unnoticed; they were not organisms to be understood, but objects to be named. Such a one-sided and sterile method could not be perpetuated in the treatment of a subject having any practical bearings, and the necessary revolt followed. Numberless facts of internal structure and organic functions, problems in physics, chemistry and electricity were then brought to light and put before the budding mind as containing the essence of botany, and now the extreme of development in this direction is being reached.

That the training of specialists is not the primary object of instruction in biology, in primary and secondary schools, or even in the college, will be admitted by all. The available time is limited, more commonly painfully short. The interest of pupils is necessarily divided and fragmentary on account of the numerous subjects they are obliged to follow simultaneously; originality and the power of clear insight are in process of destruction by a continuous surfeit of educational provender. Biology cannot hope to monopolize time or attention, and hence the first problem of instruction is to employ the meager opportunities to the greatest good of the student. The course which will obtain the maximum of pleasurable interest is also that which will produce the most lasting and satisfactory results. The teacher is the mentor and guide in the fields of knowledge. If he were in charge of a party of his pupils who were visiting England, and had a week to see London, the systematist would advise that six days be spent with the maps and guide books, so that his students might be able to call the principal buildings and streets by name while driving to Westminster on Sunday; the laboratory instructor would consistently employ the week at the Tower, mostly in careful examination of the foundations. Both suggestions would have advantages if the visitors were to remain in London six months or a year, but with the sojourn limited to a week the young people would in each case come back disappointed at not having seen the city, and this may properly be the state of mind of thousands of students of biology and its departments. They have a right to see as many and learn as much about living creatures as time and opportunity will permit; to proceed as though they were to spend a lifetime in pursuit of some biologic speciality is a piece of criminal stupidity not unfrequently alloyed with a considerable amount of laziness, since both the extreme methods are reducible to a definite class-room or laboratory routine capable of comparatively easy management, while to maintain a well-balanced middle course, giving a maximum of knowledge in logical and orderly arrangement, requires alert and sympathetic comprehension, both of facts and of persons.

But of what should general tuition in biological subjects consist? The answer must vary with the pupils, the facilities and the time. To specify any method, standpoint or sequence as the unqualified 'best' is to lose sight of the differences and

limitations which must be considered in particular cases. There are, however, some simple and universal demands which all general courses in biological subjects may be expected to meet, but which are frequently neglected in favor of the special instruction deprecated above.

1. *Formal instruction should not fall behind general knowledge in dealing with familiar things.* This does not mean that students of zoology should all become veterinarians, but it does mean that they should know something more about horses than the average of uninstructed humanity. It is no special credit to the educated man who 'had a course in botany' to be badly poisoned by contact with a weed which thousands who never heard of botany have learned to avoid. To be able to recognize the more common edible fungi is an accomplishment which none would be likely to regret. In fine, the educated man is a man none the less, and a part of nature throughout his mortal life, and any so-called instruction which does not, within its particular province, increase his efficiency in contact with his environment lacks prime elements of interest and importance.

2. *Literary development requires the command of a reasonable scientific vocabulary.* It is too late in the age of the world for whales and porpoises to be called 'fish,' for corals to be called 'insects,' for lichens to be called 'moss.' For literary purposes, if for no other, a man should know an elm from a hickory or a woodbine. The ignoramus is no longer at a premium on account of any supposed profundity. The poet who has his crows' nest in the fence corner will surely come to grief and derision, likewise he who puts the swallows' nest in the tree.

3. *To insure familiarity and subsequent recognition, natural objects should, as far as possible, be seen in nature.* The graduate from school or college who has not gained a larger insight and a deeper interest in surrounding nature and natural objects may know, without peradventure, that he has suffered a grievous loss through the incompetence of the biological contingent of the faculty. The teacher who is accustomed to carry his classes 'through' botany and zoology without taking them into the field is a dangerous fraud whose 'course' consists in some routine work or specialized sawdust which the general student can safely neglect as likely to be of minimum utility or bearing on culture.

4. *Every science should give its students a general view of its subject-matter.* At some time in the course of their biological education students should see and examine, if possible, representatives of the principal groups of animals and plants. It may or may not be desirable to go into great detail in the study of these 'types,' certainly not if thereby the other numbers of this enumeration are to be neglected. It is far better to show the general student forty different sorts of crustaceans and point out their general agreement in structure than to have him spend the time in cutting up one particular form and in learning the names of parts and organs which he never saw before and will never see again.

In the botanical text-books used in the secondary schools ten years ago only the barest mention of the lower plants was made, ferns, mosses, fungi and sea-weeds being summarily dismissed as 'Cryptogams.' In a recently published work of secondary grade the structure, organs and functions of mosses, for instance, are explained or discussed in nine different places. It is safe to say that the information furnished in this form serves to obscure already confused ideas of physiology and morphology rather than to widen and clarify the student's botanical horizon by giving him a modicum of elementary knowledge concerning an interesting group of organisms.

5. *Every science should give its students an*

introductory acquaintance with its methods of investigation. How has the science been built up? What extent of work has been accomplished and what remains to be done? What important problems are now receiving attention, and how is the work being carried on? What are the possible bearings on utility or culture of such investigations? These and numerous others are legitimate and pertinent questions being constantly asked by those inside as well as outside of scientific lines. Under this head it is desirable to make a careful dissection and thorough microscopic examination of at least one animal or plant. It is something to know how an eclipse is calculated or how a plant is 'analyzed,' even if we never attempt either feat after having 'passed up.' Together with a reasonably thorough investigation of the structure of some one form, the student should collect and learn to know the local flora or fauna in some natural group, even though a very small one. Instead of manuals of extensive regions, school purposes would be far better served by carefully written local monographs which could be made really adequate for purposes of determination in the hands of the inexperienced. By being less formidable such works need not be less scientific. Greater simplicity would also make easier the comprehension of the principles of classification and the meanings of its various categories. Repetitions and demonstrations of interesting or famous experiments are also valuable, but to confine a class in the laboratory and hurry it through a long series of such may result merely in intellectual nausea on the part of the victims.

These limited specializations are desirable as part of every general course, but the field or the problem should in each case be so narrowed that the student may reasonably be expected to gain some insight in the time available. To say that all work must be experimental or all histological or all systematic is merely to commit the same mistake in three different ways. Biology has an advantage over many parts of school curricula in that its subject-matter contains much of daily interest and permanent value. Although other departments commonly justify their existence by appeal to the fallacy that mental training can be successfully divorced from instruction, biology has less need of such an admission. The gymnasium may be theoretically the best place to secure symmetrical muscular development, but the stronger attraction is exerted by foot-ball or boat-racing, and college faculties have themselves largely to thank for the fact that these subjects monopolize so extensively the attention of undergraduates. The growing mind demands some object of tangible, contemporary, individual interest, and if this is not found in the curriculum it will be sought outside. A knowledge of foot-ball relieves many a college graduate from the charge of being a complete ignoramus. Interest in nature for its own sake is, however, also a normal and very common characteristic of younger individuals of the human species, and while the rountine of school life tends to an early eradication of this quality, its extinction is seldom complete, and the competent teacher knows how to utilize it as a most pleasant and important adjunct to the work of instruction. The popularity of the weekly excursion of classes in botany and zoology has even caused resignations from the foot-ball team.

While the training of specialists is not the object of any schools except the universities, the importance of investigators in modern civilization is too great to justify the neglect of the interests of such during the educational period. Investigators, however, of all others, need to acquire this more popular and more general knowledge of their own specialty. To be drilled from their earliest days only in methods of in-

vestigation, either systematic, structural or physiological, is to destroy originality and keep narrow the ground on which future generalizations must be built. It is accordingly plain that to limit a student's opportunities for biological instruction to a specialized course along some one line has not even the single justification it at first seemed to possess. The present extreme tendency toward 'laboratory work' and away from actual contact with nature on the part of beginners in biology is without doubt a temporary condition. Not every one who sits behind a battery of reagents in a laboratory is an investigator, and not all investigators are thus equipped.

At the cost of an equal amount of labor, which would command the general preference, an acquaintance with the more common plants of one's neighborhood or a mass of facts about plants in general, but applicable as a whole to no plant in particular? Organs, tissues and functions have been named and classified; knowledge in these directions is becoming extensive and complex, and the specialists are zealously trying to keep the beginners up with the times. Recent text-books written from structural and physiological standpoints contain a mass of definitions and an amount of classification equalling or exceeding that of the other extreme in systematic works. This classification is, indeed, not what prominently bears that name, but it is classification none the less, though artificial and based on abstractions instead of affinity or phylogeny. The details of structure and life history are arranged under such heads as 'Growth,' 'Reproduction,' 'Nutrition,' 'Irritability' and 'Symbiosis,' and the emphasis is not upon the facts in nature, but upon the mechanical or chemical considerations which must be invoked to explain the various special problems.

A complaint has been voiced that these so-called modern methods of instruction are atal to the interest and spirit which actuated the naturalists of former days, and this is not difficult to understand. Such work is preparatory only for chemists, physicists and physiologists. Its interest is not in nature, primarily, but in matter and mechanisms. Under the extreme systematic method we had introductions to plants of which we knew nothing; by the avowedly unsystematic method we learn facts about plants which we do not know.

O. F. COOK.

U. S. NATIONAL MUSEUM,
WASHINGTON, D. C.

SCIENTIFIC BOOKS.

Text-Book of General Physics for the Use of Colleges and Scientific Schools. By CHARLES S. HASTINGS, PH.D., and FREDERICK E. BEACH, PH.D., of Yale University. Boston, U. S. A., Ginn & Co.

Apart from the obvious distinction between good and bad, text-books in Physics may be divided into two well-marked classes. In the one the main point of view is to consider the study of Physics as a training of the mind; as a subject which requires the use of logical processes and which ought to develop mental accuracy and habits of thought better than any other science.

The other class of text-books does not lay so much stress upon logical methods, but calls attention rather to the phenomena of Nature which are illustrations of the great fundamental laws, and to the experimental methods by which these laws have been discovered.

The continued success of such text-books as those of Ganot and Deschanel shows that there is a great need in American colleges and schools for the class of text-book which comes under the second head, just mentioned. The most recent text-book, this by Hastings and Beach, is distinctly one of the same order. It treats the subject, however, in a thoroughly modern manner and is free from the inaccuracies of the earlier treatises. One's first impression on opening the book is of great satisfaction. The paper, type, illustrations, arrangement of matter, everything which per-

tains to the printer's art, is more satisfactory than perhaps in any modern text-book of science, and the more one investigates the book itself the more one is convinced that the authors have successfully accomplished their purposes.

The subject-matter is arranged in the following order : Mechanics, Heat, Electricity, Sound and Light. The scope of the book is rather wider than would allow its use in most colleges or schools, including, as it does, such points as radius of gyration, compound pendulums, Carnot's cycle, Thomson and Joule's experiment, entropy, virial, osmotic pressure, thermo-electricity, theory of alternating currents, impedance and so on, electric waves, efficiency of optical instruments, theories of color sensation, and wave surfaces of uniaxal and biaxal crystals. A knowledge of trigonometry and the elements of analytical geometry are presupposed for the study of the book, but no previous knowledge of physics is expected.

Each of the main subjects of Physics is discussed with considerable fulness and is illustrated by many natural phenomena and by many mechanisms and devices in common use. This is particularly true in the subjects of Mechanics and Electricity. One knows before one looks that there will be a most satisfactory explanation and discussion of optical instruments. In fact, all the chapters on Light are of marked excellence.

It should be particularly noted that special attention is paid throughout the book to the description of the various instruments used in physical measurements. The chapters on music, musical instruments and color-sensation are admirable. The book closes with an excellent index.

One may think that occasionally there is want of balance in the amount of space given various subjects and in the arrangement of these subjects. For instance, the space given the 'conservation of momentum' is only about half a page, whereas that given the centrifugal drier and the centrifugal cream separator amounts to nearly four pages. The discussion of measurement of matter and of the concept of force is most briefly stated. It may be said, however, that in a text-book of this character, where the purpose is not to acquaint students with the fundamental principles of Physics and with their logical development, but rather to give them a knowledge extending over wide fields of the phenomena of Nature and to correlate these in groups, such criticism as this is not applicable.

If one speaks of certain questions which do not seem to be treated as well as they might be, it is not from any wish to detract from the high merit of the book, but rather to call the attention of teachers who may use the book to certain points concerning which questions might be raised. In particular, it is doubtful if the chapter on Thermometry or on Calorimetry could be regarded as satisfactory by a class. It is hardly fair in defining a scale of temperature to use, as is done on page 165, the formula for the law of gases, and then to state, as is done on page 179, that "Experiment has shown that in the case of a gas under constant pressure not only is the expansion strictly proportional to the increase of temperature, but that all gases have sensibly the same coefficient." This seems to be using a quantity to define temperature and then to make use of the definition in stating a law.

Again, the words 'definite quantity of heat' are used in what may be considered an indefinite manner. On page 251 the authors use the following words: "The now universally adopted theory that heat is the kinetic energy due to the irregular motion of the molecules of a body"—a statement which is not altogether justifiable. It is possible to speak of the energy of a body and to consider it as partly kinetic and partly potential, using the latter name simply to include all energy that is not, strictly speaking, kinetic from our present knowledge; and it is possible also to say by way of definition that we will call the kinetic energy of the parts of the body by the name 'Heat.' This, however, is quite a different matter from saying that all the heat-effects are manifestations of kinetic energy, or from using the word 'Heat' in the sense of something that is 'applied' to a body, which is the sense most commonly used by the authors.

It is to be regretted that such phrases as 'molecular attractions of the particles of a solid

for those of a liquid are greater than the attractions——' p. 142; 'zinc has a greater affinity for oxygen than copper,' p. 386; 'the bond uniting the hydrogen to the acid radical SO_4 will be ruptured,' p. 388; 'an electrolyte capable of a reaction with one of the conductors,' p. 388, should be retained in a modern text-book. Exception must be taken also to the use of the word 'molecule' on p. 237 without any explanation; to the phrase 'mechanical equivalent at 15° C.,' on p. 264; to the explanation of what is meant by a 'reversible' cycle on p. 269; to the definition of the 'ampere;' to the use of the expression 'stationary waves;' and to the expression 'it is assumed that the current enters.'

Certain explanations are undoubtedly erroneous, such as those of electrolysis, scintillation and the theory of 'angle of contact' in capillarity; while others are not rigid or not definite, such as those of the simple pendulum, the barometer, Röntgen rays, iridescence.

There are several slight mistakes throughout the book, such as the incomplete statement of Döppler's principle, the use of R instead of R_0 in the two formulæ of Van't Hoff on pages 236 and 240, the statement on page 263 that there are discrepancies between the values of the mechanical equivalent as found by the two methods.

As a text-book of the character evidently planned by its authors this treatise must, however, be considered most successful. It is a book to which every student would have occasion to refer from time to time, and which contains within its covers much more matter than any existing book of its class. The style is pleasant, attractive and definite, and every laboratory and library would do well to purchase the book.

J. S. AMES.

JOHNS HOPKINS UNIVERSITY.

The Principles of Stratigraphical Geology. By J. E. MARR. Cambridge Natural Science Manuals, Geological Series. Cambridge, University Press; New York, The Macmillan Co. 1898. Pp. 304.

Here is a book on a single department of geological science which is the type of many another. Written to give students some idea of the methods and scope of stratigraphical geology, it combines a digest of the contents of larger standard manuals, with an elaboration of some points according to the author's views, and requires for its full understanding a familiarity with structural and dynamical geology, the nomenclature of paleontology, and a minute acquaintance with the local nomenclature of English geography.

The omissions in the earlier chapters imply that the student is preparing for field work after having read Lyell's Principles and Geikie's or some other text-book, while the substance of the chapters reads like lectures given to a class of beginners.

The second half of the book is by far the more valuable, in that it gives a brief, but clear and well-written summary of the stratigraphy of Great Britain, with here and there references to the more conspicuous points of stratigraphical classification in other countries. The stratigraphy of England, Wales and Scotland is described with just enough detail to bring out the differences of sedimentation in separate regions for each period, and shows the growth of the island during geological time.

A fuller treatment of this element of stratigraphy is given in Jukes-Brown's 'Building of the British Isles.'

Some of the author's peculiarities are seen in his classification and use of terms.

Lapworth's term Ordovician is adopted. In his list of systems are included Permo-Carboniferous and Permian, in addition to the Carboniferous.

The grounds of this usage are 'primarily' the recognition of an unconformity between the Carboniferous and Permian in England; and secondly, the correlation of a portion of the Salt Range strata of India as intermediate between these two 'systems' of the English column.

In the Cenozoic six 'systems' are cited, viz: Eocene, Oligocene, Miocene, Pliocene, Pleistocene and Recent; but we are told in the text that these are hardly systems in the sense in which the term is used in the case of the older rocks. Further on, the chapters describing these formations are headed as follows: 'The Eocene Rocks,' 'Oligocene and Miocene

Periods,' 'Pliocene Beds,' 'Pleistocene Accumulations,' 'The Steppe Period,' etc.

The abysmal origin of the black shales of the Ordovician, with graptolites, is defended on the following grounds: The persistence of lithological characters over wide areas; their replacement by much greater thickness of normal sediments along ancient coast lines; the frequent occurrence together of blind trilobites and those with abnormally large eyes, and the interstratification of the black shales with radiolarian cherts similar to the modern abysmal radiolarian oozes.

The glacial origin of the boulder beds of the Talchin stage of the Indian series, proposed by W. T. Blanford, is accepted; and confirmatory evidence is cited in the cases of the similar signs of glaciation in beds of a corresponding age in Australia, South Africa and southern Brazil.

As a digest of the general facts of British geology in its special nomeclature the book will be of value to those who have not access to the fuller treatises.

HENRY S. WILLIAMS.

The Examination of Water (Chemical and Bacteriological). By WILLIAM P. MASON. New York, John Wiley & Sons. 1899. Pp. 135.

The progress that has been made during the last decade in methods of sanitary water analysis, and especially in the interpretation of the results of such analysis, amply justifies an attempt at the marshalling of the new data and the revaluation of the old. To both students and practical workers the need of a really modern treatise in the English language has become imperative, and Professor Mason's little book will, on this ground, be cordially received. It will be a fact regretted by many, however, that the present work is so limited in scope. While the author correctly insists upon the paramount importance of a complete knowledge of the source of a sample of water and of the conditions under which the sample is collected, and rightly emphasizes the futility of 'standards' of purity, he has evidently not intended to include in this book any discussion of some of the other and most vital problems of water analysis.

The various methods for the determination of chlorine, nitrites, nitrates, free ammonia, albuminoid ammonia, etc., and the other significant chemical tests are described in the second chapter, and the author's selection of recommended methods will, on the whole, meet with general approval. The useful 'normal chlorine' maps, prepared respectively by the Massachusetts and Connecticut State Boards of Health, are reproduced and the hope is expressed that the task of the water-analyst will, in the future be made still easier through the preparation of similar charts by other Commonwealths.

Some analysts will consider that more stress might have been profitably laid upon the Hehner method for the determination of 'permanent hardness,' especially in view of the fact that this method has been found greatly superior to the 'soap test' in dealing with the waters in some parts of the United States. In this chapter, too, it will occasion some surprise to find no reference whatever to the Kjeldahl method for determining organic nitrogen.

In the chapter upon bacteriological examination the author seems to be treading on less familiar ground than in the preceding section. In his description of the method of preparation of sugar bouillon the importance of the preliminary removal of muscle-sugar is overlooked, as is the fact that the indol test may be vitiated by the presence of muscle-sugar in the broth. Miquel's method of examination and his theory of 'auto-infection' of waters are given a much more important place than would be accorded them by most bacteriologists. The author's statement on p. 117 that 'great cold is not fatal to germ-life' certainly needs some revision.

EDWIN O. JORDAN.

A Monograph of the North American Potentilleae. By PER AXEL RYDBERG. Memiors from the Department of Botany of Columbia University. Volume II. Issued November 25, 1898. 4to. Pp. 223. 112 plates.

Some years ago Dr. Per Axel Rydberg, a Scandinavian botanist educated in America, became interested in the group of the Rose Family which contains the *Cinquefoils*, and which have been known as the Potentilleae. Finding in the great collections of Columbia University (now transferred to the New York

Botanical Garden) a rich mass of materials, he set himself to the task of making a complete monograph of the tribe, accompanying it with such a collection of plates as would throw as much light as possible upon the limits of genera and species understood by him. After nearly two years of delay the volume has appeared, and it is all that the friends of the author anticipated, and more too. It is a beautifully printed quarto volume of 223 pages and one hundred and twelve finely executed plates.

In discussing the relationship of the tribe Dr. Rydberg regards it as representing the lowest or primitive type of the family Rosaceae, and from it arose, as separate, divergent groups, the tribes Dryadeae, Rubeae and Sanguisorbeae, while from the latter arose the Roseae (with possible relationship to the Dryadeae). On the other hand, from Dryadeae arose the Cercocarpae and Spireae, and from the latter are derived by divergent development the families Pomeae, Drupaceae and Saxifragaceae. In regard to other relationships the author says: "It is evident that the Ranunculaceae and Rosaceae are very nearly related," and in his diagram showing the foregoing relationships places the Ranunculaceae immediately below the Potentilleae.

Thirteen genera are recognized in the Potentilleae, of which the largest is *Potentilla* with 107 species. The next in point of numbers is *Horkelia* with 47 species, followed by *Fragaria* with 20, and *Drymocallis* with 13. Quite naturally, the author found it necessary to describe many new species, and occasionally to give a new name to an old species, because of the preoccupation of the old name. He has been rather conservative in this part of his work, for which he deserves our thanks. In *Fragaria* the new species are as follows: *F. crinita*, *F. sibbaldifolia*, *F. truncata*, *F. platypetala*, *F. prolifica*, *F. pumila*, *F. terrae novae*, *F. pauciflora* and *F. firma*. In the much larger genus, *Potentilla*, there are but nine new species, but this is due to the fact that Dr. Rydberg, in his work upon this genus, published many new species a couple of years ago in the *Bulletin of the Torrey Botanical Club*.

A most interesting table closes the text, giving data as to the distribution of the Potentilleae in North America. From this we learn that in California there are 64 species, in the Rocky Mountains 61, in Oregon and Washington 53, Saskatchewan Region 29, Canadian Rocky Mountains 28, Texas and Arizona 27, the Great Plains 26, New England and Middle States 26, Great Basin 23, British Columbia 22, southern Mexico 19, Labrador and Baffin's Bay 17, the Prairie Region 17, Canada 16, Alaska 16, Greenland 15, Arctic Coast 12, Southern States 8, northern Mexico 8, Lower California 7, Central America 2.

This monograph must at once become authoritative for this group of plants, and to every working botanist dealing with the higher seed-bearing plants it will be indispensable.

Charles E. Bessey.

The University of Nebraska.

SCIENTIFIC JOURNALS AND ARTICLES.

Terrestrial Magnetism and Atmospheric Electricity for March.—The promised series of portraits of eminent magneticians and electricians is begun in the present number with that of Professor Arthur W. Rücker, the President of the Permanent Committee on Terrestrial Magnetism and Atmospheric Electricity of the International Meteorological Conference. The journal has been enlarged to 72 pages, the present number being also freely illustrated and containing several important contributions by eminent investigators, as will appear from the table of contents:

Aimantation Induite par le Champ Terrestre sur les Aimants, E. Mascart.

Is there a 428-Day Period in Terrestrial Magnetism? J. F. Hayford.

Beobachtungen über die Eigenelectricität der Atmosphärischen Niederschläge, J. Elster and H. Geitel.

The Physical Decomposition of the Earth's Permanent Magnetic Field—No. 1. The Assumed Normal Magnetization and the Characteristics of the Resulting Residual Field, L. A. Bauer.

Is the Principal Source of the Secular Variation of the Earth's Magnetism within or without the Earth's Crust? L. A. Bauer.

Tafeln zur Genäherten Auswertung von Kugelfunctionen und ihren Differentialquotienten, Ad. Schmidt (Gotha).

Erdmagnetische Beobachtungen im Umanaks Fiord (Nordwest-Grönland), 1892-93, H. Stade.

Abstracts and Reviews.

Notes: Biographical Sketch of Professor Rücker. Activity in Magnetic Work.

SOCIETIES AND ACADEMIES.

THE SCIENTIFIC ALLIANCE OF NEW YORK.

A DINNER, arranged by the Scientific Alliance of New York, took place at the Hotel Savoy on the evening of April 5th. Mr. Cox presided and made an address emphasizing especially the need of bringing scientific work to the attention of those who are not special students of science. Other addresses were made by Professor Van Amringe, Professor Osborn and Mr. Leipziger, and these were followed by shorter speeches by Professor Dodge, Professor Cattell, Dr. McMurtrie, Professor Lloyd, Professor Dean, Professor Rees and Professor Hallock. At the conclusion Professor Britton, the Secretary, gave an account of the history of the Alliance in the following words:

The Scientific Alliance of New York was founded at a conference of delegates from the several societies held at the Museum of Natural History, March 11, 1891, pursuant to a suggestion made to the societies by the Council of the New York Academy of Sciences. These delegates were at first termed a Joint Commission, following the lead of the earlier established Alliance of the scientific bodies of the city of Washington. On May 19, 1891, a Constitution was adopted in which the term Council was first employed. At this time the issuing of an Annual Directory was provided for, and the first one printed was distributed in June of that year, containing the names and addresses of the 498 members of the Alliance comprised in the six original societies. The publication of the monthly Bulletin, announcing the titles of communications to be made to the societies and other matters of interest was authorized September 28, 1891. Both the Directory and the Bulletin have since been continued, with minor modifications, in the form thus inaugurated, eight numbers of the Directory and sixty-three numbers of the Bulletin having been published.

The New York Section of the American Chemical Society was admitted as a part of the Alliance in May, 1892. The second Annual Directory, issued in July of that year, shows that the membership was then 633; on November 15, 1892, the first joint meeting of the societies was held at the Museum of Natural History, and a number of addresses bearing on the progress and the needs of science in New York were delivered; these were subsequently printed in pamphlet form and widely distributed. At a meeting held November 25, 1892, a Finance Committee was appointed; this Committee secured by subscription a considerable sum of money, subsequently termed the General Fund of the Council, as distinguished from the sums annually contributed by the societies for the publication of the Directory and Bulletins, known as the Societies' Fund. The General Fund has been of the greatest value and importance in the work of the Council; it has been used in arranging joint meetings and printing proceedings of them; in supplementing the Societies' Fund; in printing circulars, and in other ways as has proved desirable; it has twice been augmented by subscription, and it is well that it should be somewhat further increased.

The second joint meeting was held March 27, 1893, also at the Museum of Natural History, in honor of the late Professor John Strong Newberry; addresses were delivered, and the proceedings were published. On April 28, 1893, the Council resolved to establish by subscription a fund to be known as the John Strong Newberry Fund for Original Research, which now amounts to about $1,200. Grants for the aid of original investigation from accrued interest on the Fund have been made to Dr. Arthur Hollick in Geology; to Mr. Gilbert Van Ingen in Paleontology, and a third grant has been recently authorized in Botany or Zoology. The Third Annual Directory, issued in August, 1893, shows that the membership had increased to 724.

The New York Entomological Society was admitted into the Alliance in March, 1894. The Fourth Annual Directory, issued in July of that year, shows an increase in membership to 818.

After approval by all the Societies and by the Council, an Act of Incorporation of the Council was introduced into the New York Legislature in 1895, and became a law on June 5th. Pursuant to this law, a new Constitution was adopted September 17, 1895. The 5th Annual Directory, July, 1895, contains the

names of 939 members; the 6th contains 1,015 names, and the 7th 1,055.

On March 16, 1898, a reception and dinner was held at the Hotel Savoy, which gave so much pleasure as to form the reason for our assembling here again to-night.

The 8th Directory, issued last fall, shows that at that time the membership had increased to 1,069; it is now known to be over 1,100—that is to say, about twice as large as in 1892–93. This great increase in the membership of the scientific societies is a certain index to the scientific progress of the city, and that this Alliance has contributed much to this well-known remarkable progress there can be no doubt.

The element that is most needed now, as it was at the formation of the Alliance, is a building which will serve as a home for the societies, where all their meetings can be held and where their proceedings and lectures may best attract more public attention; the corner-stone for this building has recently been provided by Mrs. Esther Herrman, whose generous gift of ten thousand dollars, made to the Council, brings the great desideratum nearer than it ever has been before.

GEOLOGICAL SOCIETY OF WASHINGTON.

At the 89th meeting of the Society, held in Washington, D. C., March 22, 1899, Messrs. W. C. Mendenhall and F. C. Schrader, of the U. S. Geological Survey, talked of the reconnaissances made by them the past field season in Alaska, while they were under detail with the military exploring parties sent out by the War Department.

Mr. Mendenhall spoke of a reconnaisance from Resurrection Bay to the Tanana River. He said the route followed by the military exploring party to which he was attached extended from Resurrection Bay, on the southeast shore of Kenai Peninsula, to the Tanana River, at the mouth of the Delta, one of its southern tributaries. The western continuation of the St. Elias Range was crossed by following up the valley of the Matanuski, which rises north of these mountains in a vast marshy plateau on which branches of the Copper and Sushitna Rivers also rise. Beyond this plateau extends the lofty Alaskan Range, with peaks 14,000 feet in height. The Delta River cuts a gap through these mountains, through which the explorers traveled.

The greater part of the region traversed was before quite unknown. It presents much diversity in landscape and physical features. These different types, from the snowy barriers along the Pacific to the dreary wastes of the interior, were illustrated by original views.

The geology of the various areas studied was brought out, and something of the history of the land forms as we now find them. But little gold is known in this part of Alaska, and that little is found along the coast and the adjacent parts of the mainland. Many claims have been staked since the boom struck the Cook Inlet country a few years since, and, although one or two of the richest of these yield as high as $120 a day to the man, the great majority do not pay expenses.

Mr. Schrader described a hasty reconnaissance of a part of the Copper River district. The object of the expedition was to find an all-American route from the coast into the gold districts of the Upper Yukon. A route was found which, with some engineering through three miles of canyon on Lowe River, will probably prove satisfactory.

The Copper is one of the largest rivers on the southern coast of Alaska. It heads far back of the Coast Range, but breaks through it at about 30 miles from the coast and then debouches over its large delta into the sea.

A little west of Mount St. Elias the St. Elias Range divides into two ranges; of these the main continues westward as the Coast Range around the head of Prince William Sound; the shorter range, diverging northwestward, forms the divide between the Copper, on the southwest, and the White and Tanana Rivers, on the northeast. In the fork of these two ranges, back of the Coast Range, lies the basin proper of the Copper. A lobe of the northwest range extending into the basin on the east terminates in the Wrangell group of mountains, culminating in a maximum height of more than 17,000 feet. Between Prince William Sound, on the south, and the Copper Basin, on the north, the Coast Range consists of a mountainous belt about fifty miles broad, with its general land mass rising to a height of 5,000 feet and slightly

tilted toward the coast. Its surface is studded by innumerable barren peaks and short saw-tooth ranges interspersed by glaciers and nevee. Its edges, on both the costal and inland sides, where the mountains break off abruptly, are etched by short, deep canyons and gulches, which carry off the drainage. The canyon of the Copper alone cuts through the range.

The northwest rim of the basin in the open fork of the ranges is poorly defined. It lies in a vast plateau-like tundra at an elevation of nearly 3,000 feet. The interior of the basin is occupied by a plateau-like terrain consisting principally of unconsolidated silts, sands and some gravel. It is horizontally stratified and seems to represent an extensive inland lake-bed or arm of the sea deposit covering several thousand square miles. Through this terrain the Copper River and its tributaries now flow, as a superimposed drainage, in newly-cut canyon-like valleys, at a depth of five or more hundred feet. As bed rock has scarcely anywhere been reached by erosion, the deposit is probably a thousand or more feet in thickness.

The surface of the terrain slopes gently southward and from the east and west toward the center of the basin, where its elevation is about 1,500 feet. Back from the streams it is dotted by lakelets and some swamp areas, and is nearly everywhere covered by a fair growth of timber and moss, with local areas of luxuriant grass.

At the head of Woods Canyon, where the Copper enters the mountains, all trace of the lake beds ceases, denoting apparently the barrier which confined the lake before the canyon was cut. The natural features were well illustrated by original views.

The rocks in the Coast Range are mostly sandstone, arkoses, slate, mica-schist and quartzites. On its north base some green amphibolite schist occurs. This schist seems also to form the southwest base of the Wrangell group, but the group itself seems to be mostly volcanic rocks, of which the northwestern end appears to be principally red rhyolite.

WM. F. MORSELL.

THE PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 498th meeting of the Society was held at 8 p. m. on March 18th, at the Cosmos Club. The first paper was by Dr. Artemas Martin on 'Triangles whose angles are 60° or 120° and sides whole numbers.'

From the equation $x^2 - 2xy \cos \phi + y^2 = z^2$ in which x, y, z denote the sides of *any* plane triangle and ϕ the angle included by x and y, the author deduces the general values

$$x = p^2 - q^2,\ y = 2pq - 2q^2 \cos \phi,$$
$$z = p^2 - 2pq \cos \phi + q^2.$$

When $\phi = 60°$, the sides are

$$x = p^2 - q^2,\ y = 2pq - q^2,\ z = p^2 - pq + q^2\ ;$$

and when $\phi = 120°$, they are

$$x = p^2 - q^2,\ y = 2pq + q^2,\ z = p^2 + pq + q^2.$$

He determines the limitations of the values of p and q for both cases. The smallest triangle for $\phi = 60°$ is 8, 3, 7 ; the smallest for $\phi = 120°$ is 3, 5, 7.

Numerous examples were given and tables of such triangles were submitted.

Mention was made of a paper on 'The Theory of Commensurables,' by Edward Sang, published in the Transactions of the Royal Society of Edinburgh.

The second paper was by Mr. Lyman J. Briggs on 'Electrical Methods of Investigating the Moisture Temperature and Soluble Salt Content of Soils.' The abstract of this valuable paper has not yet come to hand. The third paper was by Mr. C. K. Wead, on 'Applications of Electricity to Musical Instruments.' Mr. Wead said in part:

Electricity is to-day practically applied on a commercial scale to musical instruments in three ways: (1) As a motive power to blow organs and operate self-playing instruments. (2) To operate the pallets of large organs by means of the electro-pneumatic action patented and introduced by Barker in England in 1868, and shown at the Centennial Exhibition in 1876 by Roosevelt, of New York. (3) To control the application of power to the keys of a piano, the electric circuits being governed by the perforated paper sheet patented to Seytre in France in 1842 and to Bain in England in 1847.

Patents have been granted for specific mechanisms for applying electricity to ring bell chimes and play guitars; to record the music played on a keyboard instrument; to sustain in-

definitely the vibrations of a piano-string by impulses from an electro-magnet supplied with an intermittent current of proper frequency, and to produce 'electrical music' by the simultaneous action upon a loud-speaking telephone of several currents of proper pitch and waveform synthesized in the line-wire. If these last two inventions shall enjoy any considerable popularity they will inevitably influence, to a marked degree, musical ideas and philosophy.

E. D. PRESTON,
Secretary.

PHYSICS CLUB OF NEW YORK.

THE teachers of physics in secondary schools of New York City have formed an organization to promote efficiency in the teaching of physics. The more specific objects of the club will be to cultivate a personal acquaintance and interchange of thought among laboratory men; to secure the cooperation of the departments of physics in the colleges; to discuss matters of interest concerning laboratory methods, apparatus, new books and kindred matters.

The officers for the present year are: President, Frank Rollins; Vice President, Albert C. Hale; Secretary, A. T. Seymour; Treasurer, S. A. Lottridge. The Executive Committee consists of the officers and Messrs. R. H. Cornish, B. M. Jaquish, G. C. Sonn. The membership is limited to 30. There are at present 29 members. The next meeting will be held at the Teachers' College, April 22, 1899.

A. T. SEYMOUR,
Secretary.

SUB-SECTION OF ANTHROPOLOGY AND PSYCHOLOGY OF THE NEW YORK ACADEMY OF SCIENCES.

THE annual meeting of the Sub-section was held on Monday, March 27th. Dr. Franz Boas was elected Chairman and Dr. Chas. H. Judd Secretary for the ensuing year. The following papers were presented: 'Notes on Chilcotin Mythology,' by Dr. Livingston Farrand; 'Zapotecan Antiquities,' by M. H. Saville and A. Hrdlicka; 'Recent Suggestions for a new Psychology,' by Dr. Charles B. Bliss.

CHAS. H. JUDD,
Secretary.

DISCUSSION AND CORRESPONDENCE.

'THE EVOLUTION OF MODESTY.'

TO THE EDITOR OF SCIENCE: Mr. Havelock Ellis, in his interesting study, 'The Evolution of Modesty,' in the current *Psychological Review*, regards sexual modesty, concealment physiological and anatomical, to be mainly founded in the fear of disgusting others. But wherein, we must ask, does such fear merit the term modesty? Does this kind of fear have any distinct quality? Is it a real species? And in any case is modesty a kind of fear? It appears to me that the fear of exciting disgust in others toward ourselves is, like fear of exciting anger, hatred or any other injurious emotion, not a distinct *genus* of emotion, nor even a species of fear. We have here a more subtle and complex fear than in dodging a stone, but social fears of others' mental attitudes toward ourselves, while they form perhaps a species of fear, yet the particular fear of disgust can hardly be considered as having any peculiar quality over against fear of hatred, and other such emotions. In tracing the history of modesty-actions, Mr. Ellis is tracing not the development of a new psychosis, but merely the development of social fear with reference to a new object, the producing disgust by exposure of the body. Excretory acts in general come to be regarded as disgusting, but if I refrain from spitting in public for fear of disgusting others this can hardly be termed modesty on my part.

Modesty as a really new and significant psychosis is not to be sought in mere objective modesty-actions of the sort which Mr. Ellis considers. We see this mere objective modesty in contrast with true subjective modesty in an incident which Miss Hapgood relates in 'Russian Rambles.' While staying at a country house she was invited by the ladies to go to the ladies' bathing pool, where the Russian ladies went in without costume, and she, to her reluctance, felt obliged to imitate them, since she saw that they plainly thought that the use of clothing at such a time could be only for the hiding of defects. The Russsan ladies had no real delicacy or modesty, and had no conception of it, though they had a fear of disgusting. Real modesty as a distinct psychosis, as a regard for one's own feeling rather than for the feelings of others, resenting intrusion, calling for privacy, is a late

product of civilization. Modesty comes finally to be a feeling of reluctance to all vulgar publicity, either as to one's person or mind, a reluctance to all display, a delicacy and refinement, which is late born in evolution, and is, in psychical progress, destined to fuller and higher development, as *versus* the mere fear of disgusting, which, as Mr. Ellis shows, is in decadence in high civilization. Modesty as a mode of self-respect is quite distinct from respect and fear of others' opinions and feelings towards ourselves. Mr. Ellis, indeed, barely mentions (p. 145) modesty as a self-respect, but he seems to connect it with his general treatment. It is noteworthy that modesty should be a term which denotes actions to conceal both defects and excellences, but that real modesty is at bottom as psychosis, a personal delicacy about social conspicuousness, and may have no real psychic connection with either of the other phases, that is, it proceeds not from sensitiveness to one's own excellences or defects as viewed by others, but merely a general reluctance to have one's personality become in any wise open to public gaze and prying.

The other psychic basis of modesty-actions which Mr. Ellis mentions, namely, fear of losing in some way sexual attractiveness, may be objected to on the same ground as not real psychic modesty.

If modesty were as closely related to fear as is claimed we should expect similarity of expression, but the blush of modesty is the converse of the pallor of fear. The most brazen, unmodest woman fears exposure so far as it is disgusting to others. The blush is not the expression of fear, but of self-attentive embarrassment, and secondarily the expression of real psychic modesty. We cannot, with Mr. Ellis, relegate the influence of darkness in restraining modesty to the blushing being thereby concealed; but at least the more obvious and primary factor is that modesty and modesty-action is originally a concealment from the eyes of others, and if the eyes of others are concealed by darkness this action and feeling naturally disappear. Mr. Ellis does not explain how shame is distinct from modesty. Certainly, so far as shame is modesty shocked, it is psychologically modesty.

Our impression on the whole, then, is that while the origin and evolution of modesty-actions are as precautions against causing disgust, yet modesty as distinctive psychic quality which exhibits the same reactions is far later in date.

Hiram M. Stanley.

Lake Forest, Ill., March 7, 1899.

TRANSMITTED CHARACTERISTICS IN A WHITE ANGORA CAT.

To the Editor of Science: The following observations furnished me by Dr. S. F. Gilbert, of Elysburg, Northumberland county, Pa., concerning his white Angora cat, which I examined a short time since, may be of some interest to those working upon the subject of the transmission of acquired characters.

The cat of Dr. Gilbert is of the white Angora breed. The parentage of this cat is unknown. The mother-cat, referred to above, has the right eye blue and the left yellow, and is about three years old. The kitten of this cat is eight months old, male, and has the right eye yellow and the left eye blue, just the reverse of the mother. The kitten is subject to fits. The fits, as Dr. Gilbert describes them, are of a violent, excitable kind; the kitten running aimlessly about, falling down and scratching, or striking with its feet. These fits, which have occurred twice, lasted about ten minutes. The father of Dr. Gilbert's kitten is a large mongrel with white breast and face, the other parts of the body being zebra-colored.

The mother has had seventeen kittens, eleven of which were white, two having different colored eyes. Two of the kittens were deaf, and in general the breed seems to be very tender and difficult to raise.

John W. Harshberger.

University of Pennsylvania.

OSMOTIC SOLUTIONS.

To the Editor of Science: A letter in your columns shows that I ought to explain a special feature of the solutions used for determining osmotic pressure. In my recent paper on 'Physiological Osmosis' (Science, Vol. IX., p. 206) I cited a one-per cent. solution as having one part of sugar in one hundred parts of

water. These were the proportions actually employed by Pfeffer and given by Ostwald and others. As compared with the conventional compositiom of a 1% solution they involve a deficiency of one ninety-ninth part of the sugar, which is far within the limits of error in these investigations; nor ought they to mislead any body, as the proportions of this kind of percenticity are explained in the text-books and were given in my paper.

The departure from the conventional proportions of a one-per-cent. solution are not from error nor arbitrary, as the method of comparing the osmotic pressure of different solutions relatively to the gram-molecules of the substances dissolved involves the employment of a uniform quantity of the solvent.

G. MACLOSKIE.

PRINCETON UNIVERSITY, March 25, 1899.

NOTES ON PHYSICS.

WIRELESS TELEGRAPHY.

AT a recent meeting of the Institution of Electrical Engineers, Marconi described his recent work along the lines of wireless telegraphy. In transmitting he uses a 10-inch spark coil and a battery giving about 14 volts and 6 to 8 amperes. For his spark circuit he uses two arrangements, depending upon whether it is necessary to confine the sending of the signals to one direction or not. In the former case cylindrical reflectors are used and capacity is obtained by strips of sheet metal attached to the two spark balls. In the latter case there are no reflectors and one ball is grounded while the other is connected to a vertical wire. A Morse key in the primary circuit makes the signals. The length of the vertical wire depends upon the distance to be covered. A wire 20 feet high will transmit one mile; 40 feet, 4 miles; 80 feet, 10 miles approximately; the distance seems to increase about as the square of the height of the wire. The receiver consists of a coherer, or sensitive tube, about four centimeters long, fitted with metallic pole-pieces and partly filled with nickel and silver filings. When not under the action of the radiation the the resistance of this tube is practically infinite, but is reduced by the cohering of the filings under the action of radiation to from 100 to 500 ohms. This allows a current to flow from a local battery through a relay circuit in which is a vibrating tapper and a sounder, or writer. The former, tapping the coherer, restores the high resistance by separating the filings. The receiver is also supplied, either with the metal strips and reflector or with the ground connection and vertical wire, according as the former or the latter is used in the transmission.

When the reflectors are used the ray within which the signals can be received may be made very narrow; in one case at a distance of 1½ miles it was only about 100 feet. Marconi found that horizontal wires were useless, and accounted for this by the theory that the waves from the vertical wire had a vertical plane of polarization and were, therefore, not absorbed by the surface of the earth.

A number of installations have worked successfully and without difficulty for prolonged intervals and in all sorts of weather. In one case an 18-mile transmission was carried on with an average of about one thousand words per day. With the vertical wire transmitter, hills seem to make little difference with the transmission. In one case a distance of five miles over land, with several intervening hills, was successfully covered.

F. C. C.

BOTANICAL NOTES.

AN ELEMENTARY BOOK ON LICHENS.

IT is a hopeful sign when we find amply qualified men engaging in the work of writing elementary text-books for the use of students in the schools. It has been the duty of the writer on more occasions than he has wished to severely criticise books written for beginners by those who themselves had but little knowledge of the matter treated. It has been at once the scandal and the weakness of the elementary science text-books that they have too often contained very little Science, for the very good reason that their compilers were unacquainted with Science. Some time ago Dr. Albert Schneider published a large treatise on the lichens, which at once proved his profound knowledge of the subject as well as his ability to communicate it clearly and forcibly. It is not necessary that

we should agree with the views as to the nature of lichens held by Dr. Schneider in order to enable us to appreciate the value of the service which he has rendered to the cause of Lichenology in bringing out first his large 'Text-Book' and next his 'Guide.' The latter is intended for the use of beginners and amateurs, and since it is the only book which is adapted to their use it is of especial interest. It is now possible for a student to take up the study of these curious and very difficult plants with a reasonable hope of success. The Boston publisher, Whidden, has brought it out in an attractive form.

A TEXAS SCHOOL OF BOTANY.

The welcome announcement is made that a School of Botany has been established in the University of Texas, to become operative with the next University year. It will be under the directorship of Professor Doctor William L. Bray, of the chair of botany. The University of Texas has been noted for its progressive spirit, and this is but another illustration of the wise policy of its administrators. We learn that, in addition to the usual University instruction in morphology, physiology, ecology, etc., especial attention will be given to the botanical survey of the State. To this end the School of Botany proposes to cooperate with local botanists, secondary affiliated schools, scientific societies, etc., in all quarters of the State. Under the direction and leadership of an energetic and enthusiastic body of workers in the University, the botanists of Texas may well hope to accomplish much. The State of Texas is to be congratulated upon this forward step.

FALSE 'AIDS' IN BOTANY.

This is the time of the year when the country is flooded with circulars describing all sorts of 'aids' for use in teaching or studying botany. It must be that these worthless things are bought by ignorant teachers or school boards, for otherwise they would not be advertised so freely. We have before us one of the old-style 'Plant Analysis' sheets, published by E. R. Good, of Tiffin, Ohio, which proves that in some portions of our country the botanical world is supposed to have remained absolutely at rest for the past twenty-five or thirty years. As a leaf from quite ancient history in botany one of these sheets is interesting, but as an aid in modern botany it is simply ridiculous.

From J. M. Olcott, of Chicago, we have another reminder of the past in the form of a perforated sheet of paper called 'A System of Plant Study,' which we are told is a sample of the sheets which make up a book 'containing space for mounting and fully describing fifty-one botanical specimens,' and in addition 'full directions for collecting, pressing, mounting, photographing, analyzing and preserving plant forms and specimens.' Of course, no botanist will have anything to do with such trash, but for the non-botanical it may be well to say that this is *not* the way that botanists make herbaria and describe plants. The pupil who is so unfortunate as to use such an 'aid' will have to unlearn practically everything he learns from it.

By all odds the worst thing which has come to our attention recently is the 'Teacher's Botanical Aid,' sent out by the Western Publishing House of Chicago, and consisting of twenty-eight charts, about two feet by three, on which are rough copies of many of the illustrations found in the older text-books of botany. The copying has been done by careless or incompetent hands, so that, in spite of the author's statement that they 'will prove a direct aid in teaching drawing,' we are compelled to say that they are not only inaccurate botanically, but quite shocking from the artistic standpoint. The author intends these charts to be used in Nature Study, so that we are to have our children's time taken up by 'reciting' from these drawings under the impression that they are studying Nature. The teachers of Nature Study who know Nature, and 'who have depended for years upon their own resources' (to quote the author's words), will not think of putting these charts between the pupil and Nature, but we fear that the unprepared and uninformed may be induced to use them. If the charts were accurately drawn they would be of doubtful value in Nature Study, but with all their glaring inaccuracies they are worse than useless.

MINNESOTA BOTANICAL STUDIES.

No other State in the Union can boast of such high class work in botany as that which is pub-

lished in the Minnesota Botanical Studies as a part of the publications of the State Geological and Natural History Survey. Appearing at intervals in the form of a periodical, the 'Studies' are unique among the botanical publications of the country. Here is a case of the endowment of research which is to be commended to other States. Eight titles appear in the current number (Part II., Second Series) including 'Seedlings of certain woody plants, Comparative anatomy of hypocotyl and epicotyl in woody plants, Seed dissemination and distribution of *Razoumofskya robusta*, Observations on Constantinea,' etc., etc.

CHARLES E. BESSEY.

THE UNIVERSITY OF NEBRASKA.

THE BRAIN OF HERMANN VON HELMHOLTZ.

PROFESSOR DAVID HANSEMANN, of the University of Berlin, has contributed to the *Zeitschrift für Psychologie* (Part I. of Volume XX., issued on March 7th) an account of his examination of the brain of the late Professor von Helmholtz. Death was due to apoplexy and occurred on September 8, 1894, when Helmholtz was 73 years of age. The circumference of the head outside the scalp was 59 cm. and of the skull 55 cm. The width of the skull was 15.5 cm. and its length 18.3 cm. The cephalic index was consequently 85.25, which represents a broad head. The size of the head was about the same as that of Bismarck and slightly smaller than that of Wagner, both of whom had large heads. Darwin's head, on the other hand, was only 56.3 cm. in circumference. The weight of the brain with the coagulated blood was 1700 g. and without the blood about 1440 g., which is nearly 100 g. heavier than the average. It is, however, now generally recognized that the weight of the brain alone is not an index of mental capacity. The convolutions are more important, and here the examination of von Helmholtz's brain showed that the sulci were peculiarly deep and well marked, this being especially the case in those parts of the brain which the researches of Flechsig have shown to be concerned with associations. The frontal convolutions are so deeply cut by numerous sulci that it is difficult to follow the recognized fissures. The article contains two photographs of the brain taken from plaster casts. The brain itself has not been preserved.

We are informed, both on the authority of von Helmholtz himself and as the result of the post-mortem examination, that he had been in youth somewhat hydrocephalous, which was also the case with Cuvier, who had one of the heaviest (1830 g.) brains known. It has been maintained by Perls, and more guardedly by Edinger, that hydrocephaly in youth is an advantage in enlarging the skull and giving the brain space for growth. Hansemann thinks that the pressure on the brain resulting from slight hydrocephaly is an adequate anatomical explanation of unusual intelligence. He refrains, however, from recommending the making of geniuses by injecting fluid into the skulls of babies.

SCIENTIFIC NOTES AND NEWS.

A MEETING of the Council of the American Association for the Advancement of Science has been called by the President, Professor F. W. Putnam, and the Permanent Secretary, Dr. L. O. Howard, on Tuesday, April 18th, at 4:30 p. m., at the Cosmos Club, Washington, D. C.

THE New York Academy of Sciences will hold its annual exhibition and reception on Wednesday and Thursday, April 19th and 20th. As has been the case in other years, the first evening will be reserved for members of the Academy and specially invited guests, while a large number of those interested in science will be invited to be present on the second evening. On Thursday afternoon students of the universities and schools will be invited to attend. Tickets for Thursday afternoon or evening can probably be obtained from Professor William Hallock, Columbia University, Chairman of the Committee of Arrangements.

THE Committee of Organization of the International Geological Congress, which meets at Paris from the 16th to the 28th of August, 1900, is as follows: President, M. Albert Gaudry, professor in the Museum of Natural History; Vice-Presidents, MM. Michel Lévy and Marçel Bertrand; General Secretary, M. Charles Barrois.

DR. G. W. HILL has declined to accept the

Damoiseau Prize, which was awarded to him by the Paris Academy of Sciences last December.

MISS CATHERINE WOLFE BRUCE has, through Professor J. K. Rees, given $10,000 to Columbia University, to be used for the measurement and discussion of astronomical photographs. Miss Bruce's gifts to the department of astronomy amount to $22,100.

AT the recent session of the Legislature of Oregon the office of State Biologist was created, whose duty it is to conduct investigations on and develop the biological resources of the State. Professor F. L. Washburn, of the University of Oregon, has been appointed to the office by the Governor. A small appropriation was made for experiments in propagating Eastern oysters in Oregon waters. Professor Washburn has been working along this line for three years, and results of artificial fertilization are coming to light. Some young Eastern oysters hatched and grown in Yaquina Bay, Oregon, have recently been received.

DR. W. S. CHURCH has been elected President of the Royal College of Physicians, London.

AT the fourth annual meeting of the North Carolina Section of the American Chemical Society, the retiring President, Dr. F. P. Venable, made an address on 'The Nature of Valence.' Dr. Charles Baskerville was elected President of the Section.

AT the last meeting of the British Institution of Mechanical Engineers, Mr. Arthur Tannett Walker, a member of the Council of the Iron and Steel Institute, was elected a Vice-President in place of the late Sir Douglas Galton.

PROFESSOR R. S. WOODWARD, of Columbia University, will represent the University at the Jubilee celebrations of Sir George Stokes, to be held at Cambridge in June.

PROFESSOR HENRY S. CARHART, of the department of physics of the University of Michigan, has been granted a year's leave of absence.

M. NAUDIN, the French botanist, has died at the age of 83 years.

MADAME MICHELET, who shared with Jules Michelet the preparation of his books on natural history, has died at Paris.

A WOMAN assistant to the New York State Entomologist will be selected by civil service examination on April 22d. The duties are clerical, but require some scientific knowledge, and entomology is part of the examination. At the same time a Janitor of the Geological Hall will be chosen, with a salary of $1,200. This appears to be more than twice the salary of many museum curators.

DR. HANS DELBRÜCK, professor of history in the University of Berlin, has been fined 500 Marks and censured by the Prussian disciplinary court for criticising the action of the government in expelling Danes from North Schleswig. The prosecution proposed that Professor Delbrück be transferred from Berlin to another university. There are evident limitations to academic freedom in Germany.

THE Royal College of Surgeons, of England, was founded by royal charter in 1800, and a committee of the College has been appointed to decide whether its centenary should be celebrated and, if so, in what manner.

A COLORADO Ornithological Association has recently been organized, with Dr. W. B. Bergtold as the first President.

THE French Physical Society held its annual exhibition on April 7th and 8th.

THE opening ceremony of a Spinoza Museum took place at Rhynsburg, near Leyden, on March 24th, in the house where Spinoza lived during the last years of his life, and which has been restored in the 17th-century style. Professor Bolland, of Leyden University, delivered a speech on the life and work of Spinoza.

COMMUNICATION between England and the Continent was obtained on March 27th by the Marconi system of wireless telegraphy. The stations were at South Foreland and Wimreux, 32 miles apart. The Morse code was used, and the messages were read as distinctly as though the termini had been connected with wires.

THE gift from Mr. Llewellyn W. Longstaff of £25,000 towards a British Antarctic expedition, with the £15,000 already subscribed, assures the sending of an expedition in 1900 to cooperate with that from Germany. The Berlin Geographical Society has published a chart indicating the routes that might be followed by the two expeditions. It is proposed that the British ex-

pedition shall confine itself chiefly to the Pacific side of the Antarctic, while the German expedition explores the side facing the Atlantic and Indian Oceans.

NEWS has been received from the *Belgica*, of the Belgian Antarctic expedition. The extreme latitude reached was 71 degrees, 36 minutes south, longitude 92 degrees west. Maps were prepared of Hughes Bay and Palmer's Land, south of the South Shetland Islands.

THE expedition of Mr. H. O. Forbes and Mr. Ogilvie Grant to the Island of Socotra has returned, after successful explorations. The island has been mapped and its geological features and its fauna thoroughly studied.

IT is stated in *Nature* that the Russian expedition for taking meridian measurements in Spitsbergen will leave St. Petersburg on May 1st. Two steamers have been placed at the disposal of the expedition by the Russian Ministries of Marine and Ways and Communications, and the Minister of Finance has granted 50,000 roubles for two years. M. Bjalinizki, the zoologist, and Dr. Bunge, the Polar explorer, will accompany the expedition, which will be under the leadership of Staff-Captain Sergievski.

AN international congress against the abuse of alcoholic liquors was held in Paris from April 4th to 9th. The subjects considered included medical science and hygiene, political and social economy, legislation, instruction, education and propaganda.

THE Autumn Congress and Exhibition of the British Sanitary Institution will be held at Southampton on August 29th and following days.

THE extensive and valuable library of works in natural history collected by the late Professor Mariano de la Paz Graells, as also the botanical library of the late Professor Axel Blyt, is offered for sale by Felix M. Dames, of Berlin, from whom catalogues can be obtained.

THE annual dinner of the British Institution of Civil Engineers took place on March 15th. Speeches were made by the President, Mr. W. H. Preece; Lord Wolseley, Lord Claude Hamilton and Mr. W. L. Jackson.

WE called attention recently to the recommendation of the Select Committee of the House of Commons on the Museums of the Science and Art Department that the Frank Buckland Fish Museum should be abolished. The London *Times* states that on March 15th a memorial with a large number of signatures, including those of representatives of many piscatorial societies and the chairmen of various provincial fishery boards, was presented to the Duke of Devonshire and Mr. Ritchie, praying that this decision be withdrawn. The memorialists point out that the Select Committee consisted of 15 members, of whom seven only approved the report; three, including Sir John Gorst, voted against it, and five abstained. Against the opinion of Sir John Donnelly and Major-General Festing is cited that of Sir Richard Owen, who considered that the collection would be a most valuable appendage to the Salmon Fisheries Commission and Office. The memorial relates the history of the museum, and submits suggestions for extending its usefulness as suggested on different occasions by the Prince of of Wales and by Professor Huxley. For this the cooperation of the Board of Trade is considered essential. It should, it is submitted, be made a part of the duties of the Inspectors of Fisheries to preserve and deposit in the Museum of Economic Fish Culture any objects of permanent interest which may come under their notice, together with photographs or models of improvements in fish-passes, fish culture apparatus and appliances, and other matters useful for reference or record; while the Inspectors' knowledge and varied experience may perhaps be further utilized for the public benefit, by lectures in connection with the museum. The Secretary and Inspectors of the Fisheries Department, together, perhaps, with representatives of the Fishmongers' Company, or other important bodies connected with the sea and river fisheries, should, it is suggested, be appointed visitors to advise on and aid in the management of the museum.

UNIVERSITY AND EDUCATIONAL NEWS.

SIR WILLIAM MACDONALD has made another munificent gift to McGill University. The gift is for the School of Mining and provides for a lecturer, a demonstrator, an assistant and a com-

plete staff of mechanics, which, with his recent endowment of the professional chair, gives that department a complete staff. It also provides for the establishment of a Summer School in Mining. Sir William's present gift is about $400,000, and it raises the total amount that he has given to McGill University to over $3,000,000.

MR. WILLIAM K. VANDERBILT has made a donation of $100,000 to Vanderbilt University for the erection of a new domitory on the campus.

IT is reported that the sum of over $250,000 has been subscribed toward an endowment for Brown University. A committee is endeavoring to collect $2,000,000, which it is intended to devote to strengthening the departments already existing in the University.

A BILL has passed the Kansas Legislature appropriating $55,000 for the erection of a new chemistry building at the State University.

BY the will of the late Senator Justin S. Morrill, of Vermont, $1,000 is given to Vermont University, for the establishment of a scholarship.

MRS. FREDERICK C. T. PHILLIPS, of Lawrence, L. I., has given Harvard University an endowment of $50,000, the income to be used for the purchase of books in English literature.

THE Royal Geographical Society has offered £400 a year for five years' maintenance of a school or institute of geography at Oxford on condition that the University contribute an equal sum. The common University fund will contribute £300, and it is expected that the University chest will add £100. The school will be under the direction of the present reader, Mr. H. J. Mackinder, and an assistant and two lecturers will be appointed.

IN addition to its great Lick Observatory, the University of California is erecting an astronomical observatory for the use of students. It contains a central dome 25 feet in diameter, which will contain a 16-inch telescope, and four domes for smaller telescopes.

DEPARTMENTS of Mining Engineering and of Mechanical Engineering have been added to the School of Engineering of the University of Kansas.

THE College of Agriculture of Cornell University will conduct a school of nature-study at Ithaca for six weeks, beginning July 6th. Nearly 25,000 teachers in New York State are now receiving, at their own request, the Nature-Study publications of the College of Agriculture, and it is believed that many will be glad to attend a summer school devoted to this subject.

DR. JOHN T. NICOLSON, professor of mechanical engineering in McGill University, has accepted an appointment to the chair of mechanical and electrical engineering in the great Technical College recently established at Manchester, England.

AT the University of Kansas the following promotions have recently been made: William C. Stevens, associate professor of botany, to professor of botany; Edward C. Franklin, associate professor of chemistry, to professor of physical chemistry; Arthur St.C. Dunstan, assistant professor of physics, to associate professor of physics; Marshall A. Barber, assistant professor of botany, to associate professor of bacteriology and cryptogamic botany; George Wagner, assistant professor of pharmacy, to associate professor of pharmacy; Samuel J. Hunter, assistant professor of entomology, to associate professor of entomology; Walter K. Palmer, assistant in graphics, to associate professor of mechanical engineering; Edward Bartow, instructor in chemistry, to associate professor of chemistry.

AMONG foreign appointments we note the following: Dr. Curt Hassert, of Leipzig, has been appointed associate professor of geography in the University of Tübingen; Dr. Geppert, of the University of Bonn, professor of pharmacology in the University of Giessen; Professor Schilling, of the Institute of Technology at Karlsruhe, professor of mathematics in the University of Göttingen; Dr. Georg Karsten, of Kiel, associate professor of botany in the University of Bonn, and Dr. Dove, of Berlin, professor of botany in the University of Jena. Dr. Georg Bohlmann, docent in mathematics in the University of Göttingen, has been promoted to a professorship.

O. C. Marsh